



**ENGINEERING, PROCUREMENT, CONSTRUCTION, AND
COMMISSIONING OF 51KWP PV PROJECT FOR BANK ALBILAD
TOWER**

**Technical-Commercial Offer
Tower at Canopy**

Prepared for: **BANK ALBILAD TOWER**

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CHAPTER1: TECHNICAL DESIGN DESCRIPTION

1.1 Site Description and Analysis

1.1.1 Meteorological Data for the Sites

The primary objective of this project is to plant, design, supply, install, test, commission and operate of the photovoltaic solar systems for Bank Albilad Tower.

Site's Global and Horizontal Irradiation:

	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²
January	147.0	26.14	14.73	150.1
February	153.0	50.40	18.07	155.0
March	194.2	63.21	22.88	196.1
April	211.9	77.10	27.71	212.8
May	216.1	88.68	34.20	216.1
June	227.9	91.31	36.27	227.6
July	232.7	82.07	37.84	232.6
August	210.9	87.33	37.99	211.2
September	192.8	61.77	34.13	193.9
October	179.8	42.06	29.52	182.2
November	141.8	35.35	21.33	145.0
December	136.8	26.83	16.58	140.2
Year	2245.0	732.25	27.66	2262.7

Meteonorm

- The elevation of site is about 632 m above sea level.
- Latitude: 24°40'33.33"N
- Longitude: 46°41'18.08"E

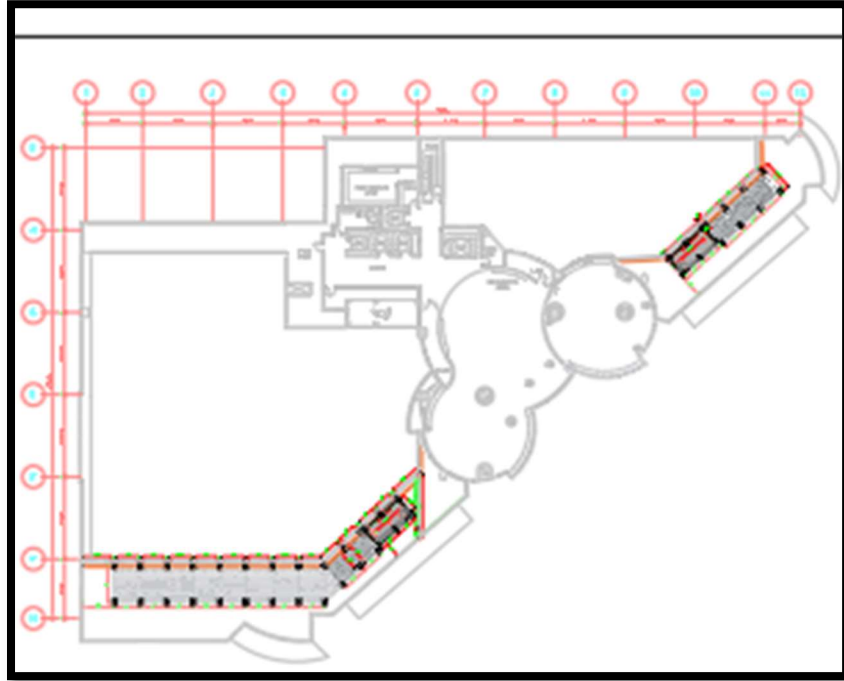


Figure 3: Site Plan.

The proposed PV system will be installed of the selected canopy of bank albilad tower provided by the Client.

The installation method of the PV Modules tow vertical steel structure with concrete foundations, the concrete foundation are installed to fix the steel structure without need to bunching the roof. The occupied area by the PV Modules is all the roof with 1 meter offset from the edge and except the stair case building.

The Size of the PV System determined based on the available area on the roof.



1.2 Technical design description:

The PV Modules distributed on the roof of the commercial building; its total area is 1268msq.

As informed by the client, the Qty of the meters is 4.

System Summary:

System Installation Type	Roof Top mounting structure
System Operation type	On grid PV system
PV Modules Type	ASTRO N7 CHSM66RN(DG)/F-BH Bifacial Series
No. of PV Modules	85 Modules
String Inverters Type	HUAWEI SUN2000-40KTL-M3
No. String Inverters	HUAWEI SUN2000-40KTL-M3 X 1
Mounting Structure	3 VERTICAL ROOF TOP
Tilt Angle	5°
Heigh from min point	2.5m
DC Capacity (KWp)	51 KWp
AC Grid (KW)	40 kW
Power Factor	Unity
DC / AC ratio	127.5%



Energy yield for the first year (KWh) @ P90	97057 KWh
Performance Ratio %	82.9%
System's Estimated Age	25 Years

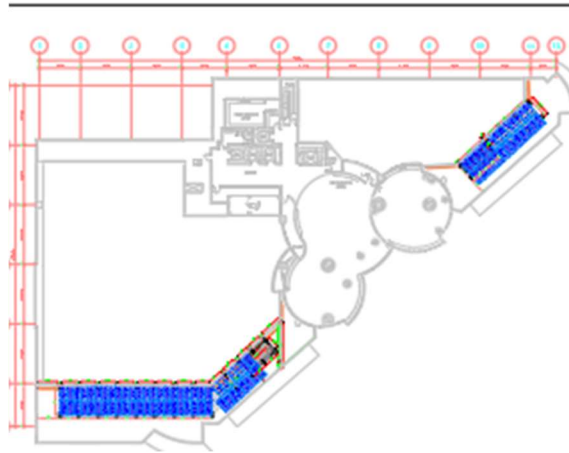
We will utilize the best of Tier-1 crystalline photovoltaic (PV) modules; in combination with the best inverters in the industry – with the objective to maximize energy yields, sustained higher than standards over 25 years. Additionally, we optimize space (area) utilization and more significantly; achieve among the highest yields per unit area or **kWh/m²** per **year**. We focus on yield analysis; input data and output data; in taking the conservative approach, and shy away from unrealistic or exaggerated numbers.

The scope of work for this solar power systems project includes the following:

1. Design, procure/manufacture, supply of a solar PV power plant including PV modules, Inverters, DC, and AC Cables.
2. Carrying out all electrical wiring concerning the Modules, Inverters, and the necessary Earthing system.
3. Detailed planning of smooth execution of the project.
4. Performance testing and commissioning of all systems.
5. Risk liability of all personnel associated with implementation and realization of the project.
6. Provision of one set of installation manual/user manual for each system. The manual includes complete system details such as array layout, schematic of the system, equipment details, working principles, etc. various aspects of design and maintenance of the offered systems.
7. Conduct of final acceptance tests according to the local and international regulations.
8. Following all safety rules including the erection of work signs, warning signs, etc. required to ensure the safety of the public and workers on the site.

Systems Summary

❖ **PV System Layout.**



❖ Single Line Diagram



❖ Earthing system Design

Connection of parts of a PV system to the earth affects:

- The electric shock risk to people in the vicinity of the installation.
- The risk of fire under faulty conditions.
- Transmission of lightning induced surges, and electromagnetic interference.

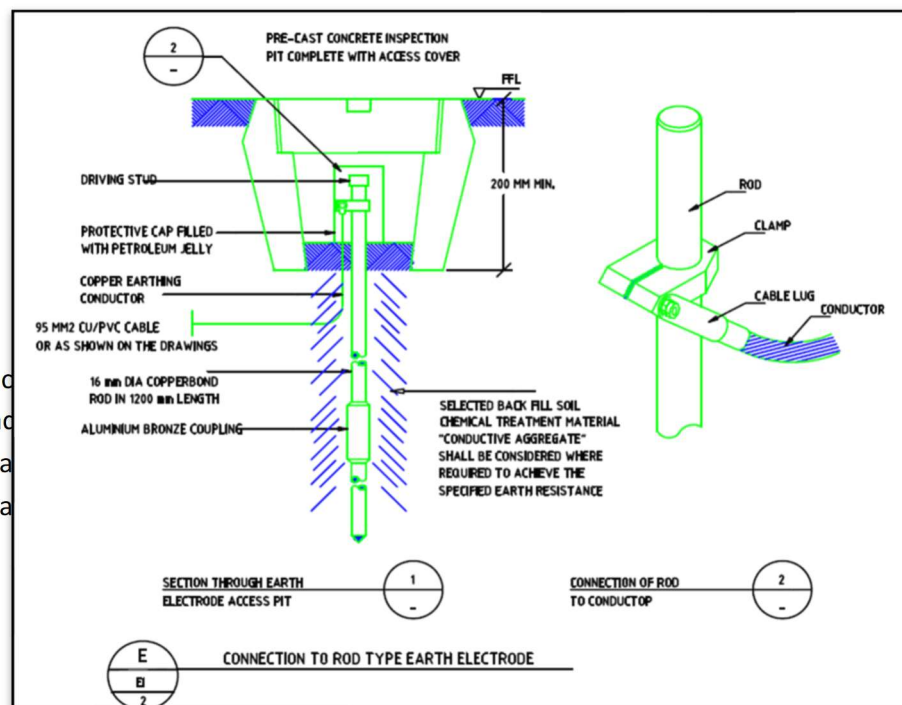
As a result, the following means will be followed in the installation of the PV:

- All the PV modules, distribution boards, and mounting structures are grounded via suitable cross sectional area wires.
- The inverters are earthed according to local codes and to manufacturer instructions.
- A residual circuit breaker will be used to protect from earth leakage.

All system's earthing procedure will be done according to local electrical codes.

❖ Labeling

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1.2 Selected Components and Equipment

At Kawar Energy, we always aim use the top and up-to-date equipment available in the market. Hereafter is a brief description of the used components.

PV Array

The PV solar generator consists of **Mono-crystalline PERC Half Cut modules** type (ASTRONERGY N7 CHSM66RN(DG)/F-BH Bifacial Series). Our used PV modules made by the **Tier 1** manufacturer Jinko Solar, are characterized by:

- PID resistance.
- Multi busbar technology.
- High module efficiency of 22.65%.
- **Certified to withstand wind load (2400 Pascal) and snow load (5400 Pascal).**
- Positive power tolerance up to 0~+3%.
- Insured 12-years product warranty and 30 years performance warranty.
- Durability against extreme environmental conditions such as high salt mist and ammonia resistance optimized electrical design and lower operating current for reduced hot spot loss and low temperature coefficient.
- Anti-corrosion material frame, electrically painted with anti-rust materials, compatible with the mounting structure used.

DC and AC Cables

The offered **DC solar cables** are manufactured by UCIC or equivalent and are characterized by their flexibility, high resistivity to UV and weather conditions, and their double insulation. They comply with utility companies' specifications and requirements.

The AC Cables for all systems will be **Cu/XLPE/PVC**, the Cables that will be buried Underground will be **Cu/XLPE/AWA/PVC**.

All the DC and AC Cables were studied and have a Voltage drop under 2%.

Inverters

The heart of any PV system is the inverter, it converts the direct current from the PV array to grid-compliant alternating current.

- The offered inverters for the On Grid systems are made by the well-known Chinese Company **HUAWEI**, are characterized by their high efficiency, over voltage protection on input and output sides, waterproof design, simplicity, and flexibility. Full technical specifications of this inverter are attached.
- The below table summarizes some technical specifications of the inverter.



Inverter	Model	Manufacturer	Efficiency	No. of Inverters	Warranty
40 kW	SUN2000-40KTL-M3	SUNGROW/ China	98.80%	1	5 Years

Other features for the Huawei inverters are that they have IP65 & IP66 protection degree; depending on the inverter's capacity, the operating temperature for both inverters is -25 ~ + 60 °C and Type II SPD on the DC and Type II SPD on the AC are included in these inverters.

AC Distribution Boards

These panels collect a group of inverters together and include the following:

- The Distribution Boxes will be made of hot coated or galvanized steel; dust and vermin proof with a protection degree IP66.
- The main distribution board will house the PV energy meter.
- The terminals and bus bars will be made of tin coated copper and appropriately sized; the boxes will have suitable cable entry with suitable glands arrangement for both input and output cables.
- Suitable markings on the bus bars will be provided to identify the bus bars.
- G99 relays.
- Digital multimeters
- Motorized main CBs.
- The distribution box will be grounded.
- The distribution boards will be completely factory assembled, pre-wired, and tested.
- All distribution boards are equipped with an appropriate SPD device.

Mounting Structure

The Mount systems need to be reliable and withstand high environmental conditions, in order to meet this requirement and simultaneously avoid the shading and maintain an acceptable output energy.

1. The mounting structure will be made of Galvanized steel.
2. Can withstand a minimum effective wind speed of 130 km/hr.
3. The mounting structure will be fitted (no welding).
4. 10 years warranty.



1.3 Codes and Standards

Below table contains the main components and equipment's used in all above-mentioned system and the codes and standards that they possess.

Category	Items	Description	Codes and Standards
Equipment	PV Module	Jinko Solar	IEC61215, IEC61730, UL1703, CE, CEC listed, and MCS, ISO9001, ISO14001: 2004, BS OHSAS18001:2007.
	Inverter	Huawei	EN 62109-1/-2, IEC 62109-1/-2, EN 50530, IEC 62116, IEC 61727, IEC 60068, IEC 61683

All designs, installation works are accomplished following all local and international regulations and standards including the laws of the Energy and Mineral Regulatory Commission, the Ministry of Energy and Mineral Resources, local authorities, and the standards of the International Electro-technical Commission (IEC).



1.4 Bill Of Quantity

NR.	PART	ITEM ID	ITEM TYPE AND DESCRIPTION	Manufacturer	Unit	Qty
		1	PV Modules-Astronergy 600Wp	Astronergy	pcs	85
		1	HUAWEI Inverter- SUN2000-40KTL-M3	HUAWEI	pcs	1
		2	2 Vertical Canopy structure 5 degrees tilt angle , 2.5Meter min height	Local	kWp	51
		4	Concrete foundation	Local	KWp	51
		5	Smart Logger	HUAWEI	pcs	1
		6	Pyranometer and sensor	HUAWEI	pcs	1
		7	LV electrical distribution board (Eclosure, Motorized 4P-100Amp MCCB, 300mA CT Troide, VT and CT)	Local	pcs	1
		8	Coupling Board with two CB of 630Amp and 1 MCCB 100Amp	Local	pcs	1
		OR	Connection direct to the existing spare breaker	Local	pcs	1
		9	Loose Material	Local	pcs	1
		9.1	Electricity meter	Local	pcs	1
		9.2	G99 Realy	Local	pcs	1
		9.3	Disconncing switch devise	Local	pcs	1
		10	Solar Cables-4mmsq	Riyadh Cables	m	700
		11	AC LV Cables-4Cx10mmsq	Riyadh Cables	m	20
		12	AC LV Cables-4Cx25mmsq	Riyadh Cables	m	50
		13	Earthing cable CU/PVC 1 x 10mmsq	Riyadh Cables	m	20
		14	Earthing cable CU/PVC 1 x 16mmsq	Riyadh Cables	m	50
		15	Surge arestor -NFS Code	Local	Pcs	2
		16	DC Cable tray 50x50, perforated with cover	Local	m	100
		17	AC Cable tray 50x50, perforated with cover	Local	m	50
		18	MC4 connectors Staubli BOTH SIDE	Stabuli	Pcs	20
		19	Accessories (Cable glands and cable lugs)	Local	LS	1
		20	Earthing system (1 Earth pit , 2 Rods, 4 Connectors, Earthing jumpers 6mmsq earth cable)	pcs	LS	1
		23	Eectrical Installation	Local	LS	1
		24	Mechanical Installation	Local	LS	1
		25	Testing and Commissioning	Local	LS	1
		26	Operation and maintenance	Local	Yr	1
IV. Engineering, Procurement & Construction Management Services						
II.	Engineering, Procurement & Construction Management Services	1	Design, Planning and Engineering for all design approvals and dossier completions			1
		2	3rd Party Engineering Studies (for all approvals)	Steel str.	LS	0
		3	System and Project design with complete drawings	-	LS	1
		4	As built drawings Consultant		LS	0



		5	SEC consultant		LS	1
		6	Lightning protection study		LS	1
		7	Water leakage and (before site mobilization)	-	LS	0
		8	Steel Structure Assessment		LS	0
		9	Regulatory and Permitting Costs	-	L.S	1
		10	Project Management and procurement Services Cost including site office/mobilization /equipment rentals etc	-	LS	1
		11	Commissioning & Commercial Operation	-	LS	1
		12	Logistics		LS	0
		13	PPE and site protocols	-	LS	1
		14	Shipping cost + Duties of mounting (DDP)	-		
		15	Local material and manpower transport costs and warehousing	-	LS	1
		16	Insurance and Bonds	-	LS	1
		17	Machines (Cranes, Telehandler, etc..)		LS	0
		18	Miscellaneous		LS	0
		19	Custom Costs		LS	1